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NOTE.—The following equations ($g$) and ($h$), and concluding remark, was enclosed by Prof. Philbrick with the corrected "proof" of his paper, pp. 9–14, and should have appeared in connection with that paper; but by accident the proof was not rec'd till after the sheet was printed, hence their appearance here, and the corrections of the proof, in the *Errata* on p. 32.

"Also

$$\int\frac{\sin^m x\cos^r x dx}{(a+b\sec x)^n}=\int\frac{\sin^m x\cos^{r+n}x dx}{(b+a\cos x)^n}, \qquad (g)$$

which may be integrated by ($a$) or by ($b$); and

$$\int\frac{\sin^m x\cos^r x dx}{a+b\,\text{co'c}\,x)^n}=\int\frac{\sin^{m+n}x\cos^r x dx}{(b+a\sin x)^n}. \qquad (h)$$

which may be integrated by ($c$) or ($d$).

Probably almost any combination of trigonometric functions may be integrated, directly or by transformation, by the general formulas above, or by others easily derived from them."

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CALCULATION OF TRANSIT OF VENUS BY PROF. BARBOUR.—This calculation is made, by T. H. Safford, Jr.'s modification of Bessel's method, for the position of Louisville, Ky., N. Lat. 38° 14′ 57″.78, Long. 85° 45′ 52″.53 W.; transit to occur on Dec. 6th 1882.

The formulæ will be found in Chauvenet's Spher. and Pract. Ast., Vol. I, and in the Amer. Naut. Almanac for 1882.

$a = A - h\sin(\mu - \lambda)$, $\qquad b = B - EK + Gh\cos(\mu - \lambda)$,

$c = -C + FK - Hh\cos(\mu - \lambda)$, $m = \sqrt{(bc)}$. If $m = a$ the assumed time is correct.—*To find time of* 2nd *contact.* Put $\varphi'$ = geocentric latitude of the place; $\lambda$ = longitude West from Greenwich; $\rho$ = dist. from Earth's center; $h = \rho\cos\varphi'$, and $K = \rho\sin\varphi'$.

An easy method of calculating $h$ and $K$ is provided by Amer. Naut. Almanac for 1882, p. 499. $\rho\cos\varphi' = F'\cos\varphi$, and $\rho\sin\varphi' = G'\sin\varphi$, in which $\varphi$ = geographical latitude, and logs $F'$ and $G'$ are given in a table.

$$\begin{array}{llll}
\log\cos\varphi = 9.8950487 & & \log\sin\varphi = & 9.7917506 \\
\log F' = \underline{.000578} & & \log G = & \underline{n\ .0024355} \\
\log h = 9.8956267 & & \log K = & n9.7941861
\end{array}$$

($n$ before a log. means that the number corresponding is negative.)

To find $a$. $\mu = 38°\ 13'\ 3''$ for epoch $2^h\ 24^m\ 57^s$ (Gr. mean time).

$\lambda = 85°\ 45'\ 52''.53$; $\therefore \mu - \lambda = -47°32'49''.53$ or $312°\ 27'\ 10''.47$. $\therefore \log\sin(\mu-\lambda) = n9.8679576$; $\log\cos(\mu-\lambda) = 9.8292395$

$$\begin{array}{ll}
\log h & = \underline{9.8956267} \\
\log h + \log\sin(\mu-\lambda) & = 9.7635843.
\end{array}
\quad \therefore h\sin(\mu-\lambda) = .580209.$$

$A$, for given epoch, $= 18.8281658$; $+.580209 = 19.4083748 = a$.

To find $b$.

$\log E$, 2nd cont., $= 9.96859$
$\log K = 9.7941861$
$\log (EK) = 9.7587761$
$EK = .57382$

$\log G$, 2nd cont, $= n9.58878$
$\log h = 9.8956267$
$\log \cos(\mu-\lambda) = 9.8292935$
$\mathrm{l}.[Gh \cos(\mu\text{-}\lambda)] = 9.3137002$

$[Gh \cos(\mu-\lambda)-EK = -.205921-.57382 = -.779741.$

B, at 2nd contact $= 6.029408$; $b = 6.029408-.779741 = 5.249667$;
$\log b = 0.7201318.$

To find $c$.

$\log F$, at 2nd cont. $= 9.96689$
$\log K = 9.7941861$
$\log (FK) = 9.7610761$
$FK = .576867$

$\log H$, at 2nd cont. $= n9.57533$
$\log h = 9.8956267$
$\log \cos(\mu-\lambda) = 9.8292589$
$\log Hh \cos(\mu-\lambda) = n9.3002156$
$Hh \cos(\mu-\lambda) = -.199625$

$C$ is intrinsically neg., ∴ it becomes pos. here being produced by — sign.
$-C = 70.961592$; $c = 70.961592+.576867+.199625 = 71.738084$
$\log c = 1.8557498$; $\frac{1}{2} \log c = .9278749$
$\frac{1}{2} \log b = .3600659$
$\log \surd(bc) = 1.2879408$; ∴ $\surd(bc)$ is 19.40621. Hence $a-\surd(bc) = 19.40837-19.40621 = +.00216$, error.

In the same manner we find for the epoch $2^{h}\ 24^{m}\ 58^{s}$, $a = 19.4056$ and $\surd(bc) = 19.4075$; consequently their difference is $-.0019$, error. So that $2^{h}\ 24^{m}\ 57\frac{1}{2}^{s}$ is a very close approximation.

In the present state of the ephemeris, the preceding calculation may seem needlessly precise. "The uncertainty of the tabular elements renders the computed times of contact doubtful by a large fraction of a minute." (Amer. Naut. Alm.) Yet by a very careful observ'n of the local or Wash. Mean Time, at Louisville, the ephemeris may be improved.

I have not taken the pains to compute the 3rd and 4th contacts, as they can be so easily observed—provided of course the sky be clear.

The dif. in time bet. Louisville and Greenwich is $5^{h}\ 43^{m}\ 3\frac{1}{2}^{s}$. Hence the Louisville Mean Time of 2nd contact should be $8^{h}\ 41^{m}\ 54^{s}$ A. M. of Dec. 6.

The 2nd contact ends for the earth generally $2^{h}\ 25^{m}\ 14^{s}.2$; and the 3rd ends at $8^{h}\ 1^{m}\ 52^{s}.7$ (G. M. T.). This gives a difference of $5^{h}\ 36^{m}\ 38^{s}.5$.

By the chart in Amer. N. Alm. the curve for $2^{h}\ 25^{m}$ runs nearly through Chicago, and sweeps around up to the extreme eastern part of Hudson's Bay. This curve is convex toward the Atlantic Ocean. The limiting curve, wh'h is the locus of the end of the 2nd contact, is concave toward the Atlantic, and passes through the Northern part of the Gulf of California and the middle of Hudson's Bay. But the dif. of time, $5^{h}\ 36^{m}\ 38^{s}.5$ will not vary more than a few seconds.—Richmond, Ky., Dec. 1, 1882.